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Circular No. 844
May 1950 • Washington, D. C.
UNITED STATES DEPARTMENT OF AGRICULTURE

Crossbred Types of Beef Cattle for the Gulf Coast Region

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INTRODUCTION

Crossbreeding of beef cattle has been in progress in the Gulf coast region for many years. Observations based on the experience of cattlemen in the region, as well as the results of scientific investigations, indicate that the so-called standard beef breeds—Hereford, Shorthorn, and Aberdeen-Angus—are not sufficiently adaptable to the humid environment, nor do they attain satisfactory size. Purebred heat-resistant Brahman and Africander cattle, although well adapted to the environment, as a rule do not have the type of beef carcass most desired by the domestic trade. Combining the natural vigor and

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heat resistance of these cattle with the beef-producing qualities of the standard beef breeds has resulted in the production of many crossbred types and one new breed of great importance.

Many ranches have carried on cross breeding but without any particular long-range plan. Much, therefore, remains to be done to maintain hybrid vigor characteristic of the first cross. The development of crossbred cattle best suited to the needs of the different sections within the region presents a problem of far-reaching importance.

Hereford, Shorthorn, and Aberdeen-Angus cattle show greater adaptation to extreme cold than to extreme heat, a fact evidenced by their popularity throughout the cold areas of the temperate zone. These breeds in the United States originated from European stock of the species *Bos taurus* and have been bred up largely in a temperate zone environment. They vary in size, color, conformation, and rate of growth but have in common certain characteristics, such as beef-type conformation, long hair, and a tendency to suffer from intense heat and to manifest low resistance to diseases and parasites common in a tropical climate.

The Africander, a native South African breed of the species *Bos indicus*, is adaptable to the Southwest, particularly during droughts. When crossed with the more popular beef breeds, the Africander has produced offspring with sufficient hardiness to cope with the climatic conditions of the Gulf coast country. This breed is relatively new in the United States, having been imported in 1931 from the Union of South Africa. It is characterized by the hump over and slightly in front of the shoulders and by the solid red color. The hump is less pendulous and blends more smoothly with the shoulders than that of the Brahman—Indian cattle also of the species *Bos indicus*. Africanders, in general, have smoother coats than Brahmans, but are rather narrow, leggy, and fine-boned.

Gulf coast breeders have also turned their attention in recent years to improving beef type by crossing grade and native cattle with purebred Brahmans. These purebred cattle vary greatly in breed, type, color, and size (*2*).[2] Characteristics common to the different breeds include a long, narrow head with horns, a hump at the withers, high shoulders, relatively straight long ribs, and narrow hips. The skin has more pigmentation and a greater number of sweat glands and is looser than that of the standard beef breeds. The hair is short and smooth and may be black, white, yellow, silvery grey, roan, or red. The rise in popularity of Brahman cattle in the United States is evidenced by an increase in registrations of purebred stock from less than 5,000 in 1940 (*7*) to more than 15,000 in 1948.[3] Demand for Brahman cattle in this country has been good, and many domestic buyers, as well as buyers from Central and South America, each year visit Gulf coast ranches to select breeding stock.

One of the outstanding examples of a breed of cattle that has been produced as a result of intelligent crossbreeding, followed by intensive linebreeding and inbreeding in order to fix desired characteristics, is the Santa Gertrudis (*3*), developed by the King Ranch in southern Texas. Based on a foundation of Brahman and Shorthorn, this new breed is red and horned. The females are excellent milkers and produce calves that usually weigh more than 500 pounds when 8 months old. The 4-year-old steers of this breed weigh approximately 1,400 pounds when finished for market off grass. These cattle inherit a satisfactory proportion of beef type from the Shorthorn breed in combination with heat and disease resistance from the foundation Brahmans. They are particularly well adapted to the hot dry conditions of southwestern Texas. The breed is becoming very popular in this area and also for export to tropical countries. The Santa Gertrudis cattle usually excel in size any of the standard beef types previously used under the same environmental conditions in southern Texas.

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[2] Numbers in parentheses refer to Literature Cited, p. 23.

[3] As reported by the American Brahman Breeders Association and the Pan American Zebu Association.

As a result of cooperative work carried on at the King Ranch, in which Brahmans × Herefords[4] and Brahmans × Shorthorns were compared with typical Hereford and Shorthorn steers, Black and coworkers (*1*) reported that the crossbreds were heavier and returned more profit per head at weaning time than did the other calves. In a 120-day dry-lot feeding period, the crossbreds brought a slightly higher price per pound and returned more profit per head than did the purebred steers, even though the feed costs were slightly higher. After feeding periods of from 150 to 179 days there was a tendency for this condition to be reversed. There was no significant difference in the carcass grades of the two types. When all factors were considered, the meat from different lots appeared to be equally desirable.

Rhoad and Black (*5*) reported results of breeding investigations carried on from 1916 to 1931 to develop a grading-up program with native Louisiana and Hereford cattle through the use of Brahman and domestic-type sires, together with foundation work with Brahman × Angus and Africander × Angus crossbred lines carried on from 1932 to 1942 at the Iberia Livestock Experiment Farm, near Jeanerette, La. This work indicates that the type of beef-cattle cross best suited to the humid and high-temperature conditions of the Gulf coast was obtained by first grading-up native cattle with purebred Hereford and Aberdeen-Angus bulls, and then crossing with Brahman bulls. When Herefords were used, best results were obtained by backcrossing with the breed to produce animals of ⅝ Hereford, ¼ Brahman, and ⅛ foundation breeding. Good but less satisfactory results were obtained by first grading-up with Hereford bulls and then crossing with Brahman bulls to produce animals of ½ Brahman, ⅜ Hereford, and ⅛ foundation breeding.

OBJECT AND SCOPE OF STUDIES

Breeding investigations have been conducted since 1932 at the Iberia station to develop strains of cattle from Brahman-Angus and Africander-Angus crossbreds that breed true for good beef type and quality and that show adaptability for the Gulf coast region, with high fertility and efficiency in feed utilization. The Aberdeen-Angus cows used as a foundation for the crossbred and purebred lines were purchased from Louisiana breeders and from herds outside the State. The Brahman bulls used were of Guzerat breeding and of excellent breed type. They were obtained from Texas breeders. The Africander bulls used were also purchased from a Texas breeder. In the initial phase of the program, reported by Rhoad and Black (*5*), both purebred and hybrid sires were used on the foundation herd, as well as on hybrid offspring. In the Brahman-Angus program three separate lines were set up, consisting of first-cross half-breds (½ Brahman-½ Angus), backcross quarter-breds (¼ Brahman-¾ Angus), and second-generation three-eighths-breds (⅜ Brahman-⅝ Angus).

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[4] In giving the breeding of crossbred cattle throughout this circular, the sire is listed first; the dam, second.

Figure 1 shows the breeding plan used with Aberdeen-Angus cows as the foundation to produce half-bred, quarter-bred, and three-eighths-bred Brahman × Angus crossbreds. Africander × Angus half-breds, also reported, were produced in the same manner as the Brahman × Angus half-breds, i. e., with an Africander bull bred to foundation Aberdeen-Angus cows. Many of the same Aberdeen-Angus cows were used in the foundation of the two crossbred lines. Two types of matings were followed to produce both quarter-bred and three-eighths-bred lines. Foundation Angus cows were mated with half-bred bulls and half-bred cows with Angus bulls, to produce quarter-bred ¼ Brahman-¾ Angus lines. Half-bred cows were mated with quarter-bred bulls, and quarter-bred cows were mated with half-bred bulls, to produce ⅜ Brahman-⅝ Angus lines. The breeding program now in progress is based on within-line matings for each established line to fix type and produce true-breeding individuals with a minimum amount of inbreeding.

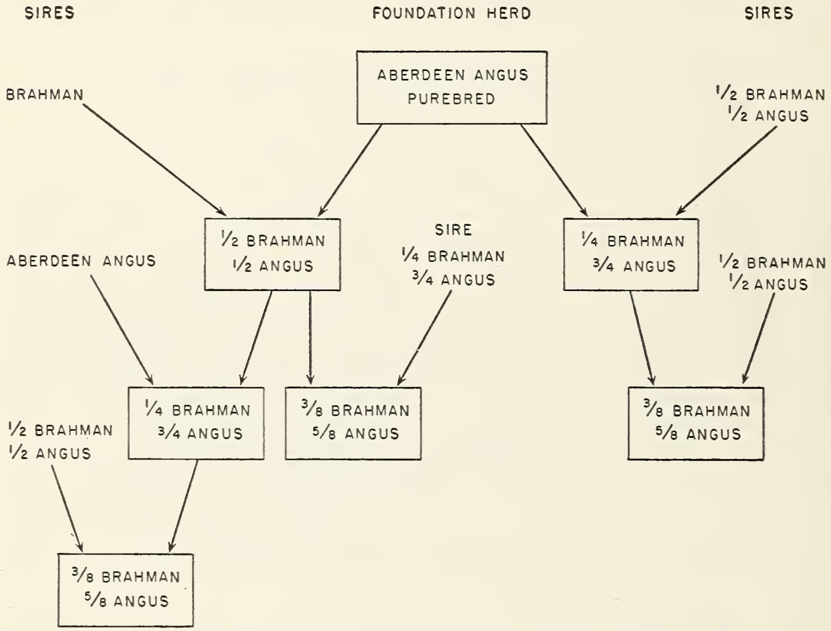

FIGURE 1.—Breeding plan used to produce half-bred, quarter-bred, and three-eighths-bred lines.

PROCEDURE

The various lines are compared on the basis of weights of females from birth to approximately 6 years of age, the results of feeding and slaughter tests with steer calves, and rectal temperature readings of crossbred females to determine heat tolerance. No weight data are included for 2-year-old heifers that dropped calves, for twin calves, or for breeding cows not nursing calves.

The cows, heifers, and herd bulls in the different lines were managed according to good range practice. Maximum use was made of native and improved pastures (fig. 2). Supplemental feeds in the form of grass silage, hay, and cottonseed meal were given for 60 to 90 days, in the feed lot and on pastures, late in the winter and early in the spring.

Figure 2.—Rounding up one of the Iberia Livestock Experiment Farm herds from a pasture at Jeanerette, La., which is typical of Gulf coast pastures.

The cows were bred to calve when 3 years of age, through a 90- to 120-day season beginning late in January. Calves were weaned and weighed in October when 6 to 8 months of age. However, because of the wide variability in the ages of calves when weaned, 6-month weights were used in the study in preference to weaning weights. Weights of cows from 3 to 6 years of age were taken in the fall when calves were weaned.

Cattle in all the classes were vaccinated against anthrax late in February or in March of each year, and calves retained for replacement were vaccinated against brucellosis and blackleg. In addition, breeding cows were blood-tested annually for brucellosis and periodically for tuberculosis. During recent years, it has been the practice also to treat calves with phenothiazine for stomach worms at weaning time, and all other animals when their physical condition indicates a stomach worm infestation. Salt and bonemeal were available to the cattle at all times, the meal being used to correct phosphorus and calcium deficiencies if present.

Representative steer calves of purebred Aberdeen-Angus breeding and crossbred steer calves from 5 Brahman-Angus and Africander-Angus lines were fed out on standard fattening rations from an average weaning weight of about 400 to 450 pounds to a slaughter weight of about 750 pounds to determine the efficiency of gains and the quantity and quality of beef produced. A total of 75 calves were fed from 1935 to 1940, inclusive. They were full-fed individually 6 parts by weight of cracked corn (No. 2 grade) and 1 part of cottonseed meal (43-percent protein) with grass hay at will. Individual weights were taken at the beginning and at the close of the test. The calves were graded as feeders at the beginning of the test and as slaughter cattle at the close.

In 1945 and 1946, calves were sold for slaughter at weaning time, at approximately 7½ months of age, because of a scarcity of concentrates for fattening during the war. However, this practice was more in accord with that of the Gulf coast region than that used earlier in the investigation, since a large proportion of the calves produced in the region are sold for slaughter at weaning time. The calves were sold in two groups each year, one early and one late consignment, in order to equalize age differences and allow late calves all possible chances to make normal development. Weaning weights were taken on station scales, and the calves were transported by truck on the same day to Lake Charles, La., where sales weights were obtained. They were slaughtered on the second day. On the third day, after the carcasses had chilled from 24 to 36 hours, they were graded and weighed.

In the heat-tolerance studies to measure the adaptability of crossbred cattle, initial heat-tolerance experiments reported by Rhoad (*4*) led the way for the development of a simple field test to determine body temperature and a formula for use in calculating heat-tolerance coefficients on an individual basis. This formula, known as the Iberia heat-tolerance test for cattle, is as follows:

$$100-[10(BT-101)]$$

in which BT=average body temperature based on rectal temperature readings (made at 10 a. m. and 3 p. m. on 3 different days) with the average air temperature 85° F. or more (cattle held in unprotected area during test period, with access to water, but having no shade); 101=normal body temperature of cattle; 10=a factor to convert degrees' deviation in body temperature from the normal to a unit basis; 100=perfect efficiency in maintaining temperature at 101° F.

With the use of this formula, an animal with an average body temperature of 103.8° F. would have a heat-tolerance coefficient of:

$$100-[10(103.8-101)]=100-[10(2.8)]=72$$

During the different phases of the temperature work, there was some variation in recorded air temperatures, but no attempt was made to correct heat tolerance to a uniform temperature basis. In the early studies, purebred Aberdeen-Angus and Brahman cows and Brahman-Angus half-bred cows were included. In studies conducted after 1941, Brahman-Angus half-bred, quarter-bred, and three-eighths-bred lines and Africander-Angus half-breds, classified according to age and productivity, were used.

In the course of the crossbreeding work, observations on the appearance of the various crosses were made. These included conformation, vigor, coat color, type of hair, and presence or absence of horns.

WEATHER CONDITIONS DURING EXPERIMENT

Information on climate, as indicated by temperature and rainfall records, is a valuable aid in determining the type of livestock best adapted to a specific region. A study has therefore been made of

TABLE 1.—*Monthly and annual rainfall at Iberia Livestock Experiment Farm, Jeanerette, La., 1932–47*

Month	1932	1933	1934	1935	1936	1937	1938	1939	1940	1941	1942	1943	1944	1945	1946	1947	Average
	In.	*In.*	*In.*	*In.*	*In.*	*In.*	*In.*	*In.*	*In.*	*In.*	*In.*	*In.*	*In.*	*In.*	*In.*	*In.*	*In.*
January	9.8	4.6	5.9	3.4	2.9	7.1	5.1	2.5	3.2	3.0	1.3	2.4	7.1	7.7	5.8	6.3	4.9
February	3.0	4.3	5.0	5.0	4.3	1.6	3.1	3.2	6.1	2.4	7.7	2.1	3.8	4.6	4.6	1.2	3.9
March	3.6	5.2	3.0	6.1	1.6	5.6	1.3	.6	2.9	6.0	5.5	7.7	5.7	3.1	9.6	12.3	5.0
April	2.5	3.1	1.6	4.9	(1)	2.7	4.1	3.6	7.5	3.9	5.6	1.9	3.0	4.6	2.7	6.7	3.9
May	5.0	5.5	3.8	4.6	(1)	2.8	3.2	6.6	2.1	7.8	4.9	3.0	6.6	5.2	9.5	8.0	5.3
June	5.4	3.5	7.6	5.3	(1)	4.2	2.8	2.0	11.4	11.4	13.0	7.1	5.1	3.5	10.7	4.1	6.5
July	3.3	10.2	6.8	5.4	9.2	7.8	8.4	9.2	9.1	10.3	4.2	4.0	7.5	5.4	22.9	4.7	8.0
August	6.4	5.4	8.6	6.6	5.5	4.6	3.0	5.0	13.8	2.8	7.7	3.2	6.1	10.6	4.7	8.1	6.4
September	6.2	1.6	2.7	5.5	2.6	4.4	2.2	1.3	3.2	7.0	11.2	18.1	7.1	3.1	5.6	3.9	5.3
October	7.1	1.2	1.3	.9	.6	6.1	1.0	1.8	.1	4.9	4.5	1.1	1.2	4.3	3.0	1.2	2.5
November	4.2	2.2	7.7	1.2	3.1	1.9	1.5	4.7	5.1	2.6	0	4.4	10.8	1.8	8.3	9.9	4.3
December	7.4	5.1	2.3	5.8	3.0	4.2	3.9	2.0	10.6	3.5	2.7	7.2	3.6	5.8	3.3	5.9	4.8
Total	63.9	51.9	56.3	54.7	[2] 32.8	53.0	39.6	42.5	75.1	65.6	68.3	62.2	67.6	59.7	90.7	72.3	60.8

[1] Records unavailable.

[2] On the basis of 9-month records.

TABLE 2.—*Average temperatures at Iberia Livestock Experiment Farm, Jeanerette, La., 1932–47*

Month	1932	1933	1934	1935	1936	1937	1938	1939	1940	1941	1942	1943	1944	1945	1946	1947	Average
	° *F.*	° *F.*	° *F.*	° *F.*	° *F.*	° *F.*	° *F.*	° *F.*	° *F.*	° *F.*	° *F.*	° *F.*	° *F.*	° *F.*	° *F.*	° *F.*	° *F.*
January	59. 2	58. 6	57. 3	56. 7	52. 0	64. 4	55. 1	57. 7	42. 4	54. 8	49. 0	51. 5	51. 9	51. 9	53. 4	52. 5	54. 3
February	65. 5	57. 0	56. 1	58. 0	53. 4	56. 1	62. 0	61. 5	53. 8	50. 9	51. 2	56. 7	62. 1	58. 7	54. 8	48. 2	56. 6
March	57. 3	63. 0	60. 9	66. 4	64. 1	59. 0	70. 0	64. 2	60. 9	55. 2	58. 4	58. 6	61. 2	67. 5	63. 2	55. 2	61. 6
April	68. 2	68. 3	70. 1	69. 8	(1)	66. 0	68. 7	68. 9	68. 8	66. 5	67. 1	69. 3	68. 3	70. 5	69. 9	70. 1	68. 7
May	73. 0	77. 7	74. 6	76. 3	(1)	75. 2	74. 8	73. 9	73. 6	77. 0	74. 3	77. 4	74. 6	72. 3	75. 0	74. 8	75. 0
June	79. 6	77. 5	81. 5	80. 1	(1)	81. 7	81. 0	81. 2	79. 2	80. 1	80. 3	81. 2	81. 7	79. 6	78. 1	80. 9	80. 2
July	82. 8	80. 4	81. 5	82. 6	82. 6	83. 1	82. 0	77. 7	81. 9	81. 4	81. 4	81. 4	83. 2	81. 0	80. 9	80. 4	81. 5
August	81. 5	81. 1	81. 6	84. 5	82. 4	83. 0	82. 6	82. 4	79. 7	83. 0	81. 5	81. 7	82. 6	80. 9	81. 5	81. 7	82. 0
September	77. 0	80. 8	78. 5	76. 1	81. 0	77. 5	77. 2	79. 9	74. 8	79. 4	75. 1	74. 7	78. 9	79. 4	77. 6	78. 9	77. 9
October	65. 8	70. 1	72. 3	71. 2	69. 6	69. 3	69. 8	51. 6	67. 6	76. 0	69. 8	63. 9	67. 0	67. 4	70. 3	73. 5	68. 4
November	54. 3	61. 7	63. 3	59. 5	57. 0	57. 7	59. 8	57. 3	59. 6	56. 5	62. 6	56. 3	60. 8	63. 1	63. 9	57. 8	59. 4
December	55. 3	63. 0	55. 4	50. 9	57. 2	53. 6	55. 0	37. 6	57. 6	56. 5	54. 0	53. 1	51. 8	49. 3	58. 1	53. 8	53. 9
Average annual	68. 3	69. 9	69. 4	69. 3	[2] 66. 6	68. 9	69. 8	66. 2	66. 7	68. 1	67. 1	67. 1	68. 7	68. 5	68. 9	67. 3	68. 3

[1] Records unavailable.

[2] On the basis of 9-month records.

the temperature and precipitation at the Jeanerette station for 1932 to 1947, inclusive, as shown in tables 1 and 2.

The Gulf coast area, in which this station is located, is subtropical and has a high rainfall except in an arid region in the vicinity of Brownsville and Corpus Christi, Tex., where the annual rainfall is normally 20 to 25 inches. A humid region extends eastward, with a gradual increase in rainfall from 44.8 inches at Houston, Tex., to 62.2 inches at Bay St. Louis, Miss. Maximum temperature ranges from 98° F. at Tampa, Fla., to 110° at Baton Rouge, La. Snow rarely falls in this area, but mean temperatures as low as 1° have been recorded in southern Mississippi.

At Jeanerette, La., where the experiment reported in this circular was conducted, the annual rainfall is exceedingly heavy, averaging about 60 inches during a 16-year period, as shown in table 1. During 3 of these years, more than 70 inches of rain fell each year, and in no year during which complete records were kept was precipitation less than about 40 inches. On the average, the heaviest rainfall occurred from May to September, but in some years—1932 and 1940, for instance—rainfall was very heavy during the winter months.

As shown in table 2, the mean temperatures at Jeanerette for the 16-year period were comparatively high, and the variation in temperatures was not great—only 28° between the hottest months (July and August) and the coldest ones (December and January). Furthermore, the mean temperatures for any given month during the period were highly consistent. For instance, for August there was a variation of only 5° throughout the entire period; for September, 6°; and for November, 10°. Consequently, the mean temperatures shown in table 2 for the entire period are representative of those for any given year. A comparison of the two tables shows that the environment of the area as a whole is not favorable for optimum beef production from the breeds of beef cattle popular in northern areas.

Observations have shown that animals with Brahman breeding can graze without apparent discomfort when the temperature and humidity are high enough to force cattle descended from European ancestry to seek shade.

EXPERIMENTAL RESULTS

Table 3 shows the specific types of matings used to produce each line of crossbred cattle, the number of females at different periods, and the average weights from birth to 6 years of age over a 14-year period. As previously stated, weights of cows at 3, 4, 5, and 6 years of age were taken in the fall when calves were weaned. The significance of differences, given throughout the results, were determined by the methods for analysis of variance given by Snedecor (*6*).

WEIGHTS OF HEIFER CALVES

Average birth weights of heifer calves ranged from 55.5 pounds for purebred Aberdeen-Angus to 66.2 pounds for half-bred Brahman-Angus. Differences between the crossbred and the purebred Aberdeen-Angus calves were statistically significant, but between the crossbred lines differences were not significant. The greatest varia-

TABLE 3.—*Average weights of females from birth to 6 years of age (1932 through 1946)*

Breeding of cattle[1]	At birth			At 6 months			At 1 year			At 2 years		
	Number	Weight	Standard deviation	Number	Weight	Standard deviation	Number	Weight	Standard deviation	Number	Weight	Standard deviation
		Pounds	*Pounds*		*Pounds*	*Pounds*		*Pounds*	*Pounds*		*Pounds*	*Pounds*
Aberdeen-Angus (Angus × Angus)	27	55.5	6.74	27	292.5	36.13	18	435.0	62.33	16	698.1	89.98
Brahman-Angus:												
Half-breds—												
First-generation (Brahman × Angus)	56	66.2	8.84	56	349.5	42.94	50	560.6	79.68	47	766.4	93.86
Second-generation (half-bred × half-bred)	21	61.6	10.32	21	375.2	51.60	14	520.4	88.28	9	732.2	102.08
Quarter-breds—												
First-generation (Angus × half-bred)	54	61.7	8.23	54	392.0	35.99	51	603.1	63.48	46	766.4	84.75
First-generation (half-bred × Angus)	42	62.9	12.23	42	353.4	48.91	39	550.9	70.44	38	737.5	73.23
Total or average	96	62.2	10.13	96	375.1	46.10	90	580.5	71.13	84	753.3	80.59
Second-generation (quarter-bred × quarter-bred)	50	60.6	10.71	50	356.2	43.17	43	503.4	80.18	34	672.9	82.91
Three-eighths-breds—												
First-generation (quarter-bred × half-bred)	24	62.4	11.76	24	395.7	42.97	20	521.0	83.86	20	691.8	77.70
First-generation (half-bred × quarter-bred)	24	64.7	9.44	24	360.0	36.65	23	470.2	75.48	15	671.3	84.76
Total or average	48	63.5	10.61	48	377.9	43.41	43	493.8	82.60	35	683.0	80.23
Second-generation (three-eighths-bred × three-eighths-bred)	15	63.1	13.20	15	374.3	44.53	14	478.2	73.19	9	685.9	74.54
Africander-Angus:												
Half-breds—												
First-generation (Africander × Aberdeen-Angus)	31	63.8	12.46	31	349.7	53.13	28	527.5	75.41	28	725.2	83.35
Second-generation (half-bred × half-bred)	15	63.7	10.07	15	322.1	36.12	14	503.2	55.04	14	694.3	46.57
Total or average of all crossbreds[2]	332	63.1	10.48	332	363.5	45.38	296	537.0	64.59	260	726.4	82.94

Breeding of cattle[1]	At 3 years[3]			At 4 years[3]			At 5 years[3]			At 6 years[3]		
	Number	Weight	Standard deviation	Number	Weight	Standard deviation	Number	Weight	Standard deviation	Number	Weight	Standard deviation
		Pounds	*Pounds*		*Pounds*	*Pounds*		*Pounds*	*Pounds*		*Pounds*	*Pounds*
Aberdeen-Angus (Angus × Angus)	12	785. 0	104. 05	7	849. 7	45. 49	12	868. 3	85. 53	9	910. 5	104. 27
Brahman-Angus:												
Half-breds—												
First-generation (Brahman × Angus)	29	895. 9	101. 44	22	1, 011. 7	118. 88	20	1, 032. 5	96. 81	18	1, 047. 8	85. 03
Second-generation (half-bred × half-bred)	------	------	------	------	------	------	------	------	------	------	------	------
Quarter-breds—												
First-generation (Angus × half-bred)	33	886. 5	76. 43	20	894. 5	87. 79	20	977. 5	117. 75	18	982. 8	145. 48
First-generation (half-bred × Angus)	23	867. 4	77. 90	14	896. 1	81. 34	10	951. 0	63. 81	7	969. 3	52. 70
Total or average	56	878. 7	76. 92	34	895. 1	83. 93	30	968. 7	102. 50	25	979. 0	125. 40
Second-generation (quarter-bred × quarter-bred)	9	757. 2	93. 11	------	------	------	------	------	------	------	------	------
Three-eighths-breds—												
First-generation (quarter-bred × half-bred)	5	787. 0	130. 84	2	882. 5	152. 03	2	985. 0	113. 14	2	980. 0	42. 43
First-generation (half-bred × quarter-bred)	8	810. 6	82. 22	3	933. 3	32. 15	2	925. 0	49. 50	2	977. 5	60. 10
Total or average	13	801. 5	98. 96	5	913. 0	84. 08	4	955. 0	79. 27	4	978. 8	42. 50
Second-generation (three-eighths-bred × three-eighths-bred)	------	------	------	------	------	------	------	------	------	------	------	------
Africander-Angus:												
Half-breds—												
First-generation (Africander × Aberdeen-Angus)	21	880. 7	94. 61	12	932. 5	103. 25	15	1, 002. 0	104. 81	7	1, 037. 9	108. 55
Second-generation (half-bred × half-bred)	9	817. 2	89. 52	2	917. 5	130. 82	------	------	------	------	------	------
Total or average of all crossbreds[2]	137	863. 3	89. 25	73	937. 6	98. 89	69	993. 6	100. 42	54	1, 009. 5	107. 37

[1] Sire given first; dam, second. [2] Aberdeen-Angus excluded.

[3] Data based on fall weights from cows that weaned calves; weights taken at time of weaning.

tion in weight at birth, as measured by the standard deviation, occurred in the second-generation three-eighths-bred Brahman-Angus calves from within-line matings; the least variation occurred in the purebred Angus calves.

The average weight at 6 months of age was significantly greater for calves out of half-bred Brahman-Angus cows than for calves out of purebred Aberdeen-Angus cows, irrespective of sires. Purebred Aberdeen-Angus calves were significantly lighter in weight than calves from any crossbred mating. Six-month weights obtained when Brahman-Angus half-bred cows were mated with purebred Angus bulls to produce quarter-bred progeny were similar to those obtained when these cows were mated with quarter-bred bulls to produce three-eighths-bred progeny. Similar weights were also obtained when purebred Aberdeen-Angus cows were mated with Brahman, Africander, or half-bred Brahman-Angus bulls. Six-month weights of calves produced by Brahman-Angus quarter-bred cows mated with half-bred bulls to produce three-eighths-bred progeny, and with quarter-bred bulls to produce second-generation quarter-breds, were similar and not significantly different from weights of calves produced by purebred Aberdeen-Angus cows mated with Brahman, Africander, or Brahman-Angus half-bred bulls. Backcross Brahman-Angus quarter-bred calves as a group, based on 96 head, weighed approximately the same at 6 months of age as first-generation three-eighths-bred calves, based on 48 head. These weights were significantly heavier than the weights of calves from half-bred Africander-Angus cows.

Second-generation Brahman-Angus half-bred calves out of the first-generation half-bred cows weighed significantly more than first-generation half-bred calves out of purebred Angus dams, whereas differences between first- and second-generation Africander-Angus calves were not significant. Six-month weights of second-generation three-eighths-bred calves from within-line matings were not significantly different from the average for all first-generation three-eighths-bred calves or second-generation Braham-Angus half-bred calves. Second-generation Africander-Angus calves weighed less at 6 months of age than crossbred calves of any other type.

The full value of hybrid vigor, derived from mating Brahman and Aberdeen-Angus cattle in a crossbreeding program, cannot be realized from a calf-production standpoint until the hybrid cows have produced calves.

WEIGHTS OF YEARLING AND 2-YEAR-OLD HEIFERS

Weights of yearling heifers, as shown in table 3, ranged from 603.1 pounds for backcross quarter-breds out of half-bred Brahman-Angus dams to 435.0 pounds for purebred Aberdeen-Angus. First-generation half-breds weighed 560.6 pounds, which was not significantly less than the average for all backcross quarter-breds. Greatest gains from 6 to 12 months were produced by these half-breds and quarter-breds, and the least gains by the three-eighths-bred lines. Three-eighths-bred heifers out of half-bred dams failed to develop as rapidly as quarter-bred heifers out of half-bred dams and weighed significantly less at 12 months of age.

Second-generation half-bred Brahman-Angus heifers weighed 520.4 pounds at 12 months of age and did not differ significantly from second-generation quarter-breds, first- and second-generation three-eighths-breds, or first- and second-generation Africander-Angus. Greatest variability, as measured by the standard deviation of 12-month weights, occurred with second-generation Brahman-Angus half-breds; whereas the least variability occurred with second-generation Africander-Angus half-breds.

Average weights of 2-year-old heifers, as shown in table 3, ranged from 766.4 pounds for first-generation Brahman-Angus half-breds and for the quarter-breds produced by half-bred dams mated to Aberdeen-Angus sires, to 671.3 pounds for the first-generation three-eighths-breds produced by mating quarter-bred dams to half-bred sires. As expressed by the standard deviation, the greatest variability (102.1 pounds) was noted in the second-generation Brahman-Angus half-breds, and the least variability (46.6 pounds) in the second-generation Africander-Angus half-breds. The weights of the first-generation Brahman-Angus half-breds were equalled by those of the backcross quarter-breds out of first-generation half-bred cows and did not differ significantly from the weights of all backcross quarter-breds, second-generation half-breds, or first-generation Africander-Angus half-breds. However, they were significantly heavier than the weights of the purebred Aberdeen-Angus, first- and second-generation three-eighths-breds, second-generation quarter-breds, and second-generation Africander-Angus.

Second-generation quarter-bred heifers, produced by within-line matings, weighed significantly less than their backcross dams and first-generation half-breds, but did not differ significantly from second-generation Brahman-Angus half-breds, first- and second-generation three-eighths-breds, second-generation Africander-Angus, or purebred Aberdeen-Angus.

WEIGHTS OF WITHIN-LINE PROGENY 6 MONTHS TO 2 YEARS OF AGE

Growth records from birth to 2 years of age for females produced by within-line matings, such as half-bred sires × half-bred dams and quarter-bred sires × quarter-bred dams, indicate that these individuals fell significantly below their dams in most instances. Second-generation quarter-breds had significantly lower weights at 6 months, 1 year, and 2 years of age than backcross quarter-bred dams. This group of second-generation cows weighed significantly more than purebred Aberdeen-Angus at birth, 6 months, and 1 year of age and were lighter, though not significantly so, at 2 years. Second-generation Brahman-Angus half-breds were heavier but not significantly so, on the average, than first-generation cows at 6 months, and were lighter, but not significantly so, at birth, 1 year, and 2 years of age. Second-generation three-eighths-bred heifers had practically the same weights as their dams at birth, 6 months, 1 year, and 2 years of age. Second-generation Africander-Angus half-breds were lighter, but not significantly so, than the first-generation line from birth through 2 years of age.

Weight records for second-generation Brahman-Angus and Africander-Angus half-bred, second-generation quarter-bred, and second-generation three-eighths-bred heifers indicate that differences between groups were statistically significant at 6 months of age, but not at birth or at 1 and 2 years of age. The Brahman-Angus half-breds were the heaviest at 6 months, 1 year, and 2 years. The Africander-Angus were lightest at 6 months, the three-eighths-bred Brahman-Angus at 1 year, and the second-generation quarter-bred Brahman-Angus at 2 years. The Brahman-Angus three-eighths-breds and the Africander-Angus had the heaviest birth weights.

Least variation from the dam's performance occurred with three-eighths-bred heifers. The greatest loss in weight from the parent line occurred with the second-generation quarter-breds, which, at 2 years of age, weighed 80.4 pounds less than backcross quarter-bred cows and 25.2 pounds less than purebred Angus.

As indicated by the standard deviations, purebred Aberdeen-Angus calves had the least variation in weight at birth, and the purebred Aberdeen-Angus, backcross quarter-breds from half-bred dams, and second-generation Africander-Angus had the least variation in 6-month and yearling weights. The least variation at 2 years of age is shown by the second-generation Africander-Angus. Greatest variation is shown by within-line three-eighths-breds at birth, by first-generation Africander-Angus half-breds at 6 months, and by second-generation Brahman-Angus half-breds at 1 and 2 years. Second-generation Brahman-Angus half-breds had more variability than the first-generation group at all ages.

WEIGHTS OF BREEDING COWS FROM 3 TO 6 YEARS OF AGE

Half-bred Brahman-Angus cows, as shown in table 3, weighed 895.9 pounds as 3-year-olds and 1,047.8 pounds as 6-year-olds. At 3 years of age they were similar in weight to backcross quarter-bred cows and first-generation Africander-Angus half-breds and were heavier than within-line-mated quarter-breds, second-generation Africander-Angus halfbreds, or purebred Angus. At 6 years of age they were similar in weight to first-generation Africander-Angus cows and were significantly heavier than purebred Aberdeen-Angus or the quarter-bred and three-eighths-bred lines. Information on the three-eighths-bred line is limited, and the numbers involved are too small to permit definite conclusions.

BEEF PRODUCTION

In the tests with steer calves, first- and second-generation Brahman × Angus half-breds and first-generation Africander × Angus half-breds reached a weaning weight of approximately 450 pounds in the shortest time (table 4). First-generation three-eighths-bred steers required about 15 days longer than the second-generation quarter-breds. The purebred Angus calves were weaned when older than any of the other groups. Yet they reached an average weight of only 404 pounds. The Brahman × Angus half-breds made the largest and the purebred Angus the smallest daily gain from birth to weaning. Calves from both groups had purebred Angus cows as dams.

The Brahman × Angus half-breds gained a little faster on feed than the other crossbreds and reached an average weight of about 750 pounds in a shorter time. The Africander × Angus reached this weight in a shorter time than the two remaining groups. The three-eighths-bred steers required 4 more days than the quarter-breds. Purebred Angus steers required 294 days and were the oldest groups at time of slaughter, but had the highest grading carcasses. Differences in efficiency of gain between groups during the feed-lot period were not statistically significant. The crossbreds, therefore, made as efficient gains as the purebred Angus.

TABLE 4.—*Average beef-production data for purebred and crossbred steers fed to a final weight of about 750 pounds*

Item	Purebred Aberdeen-Angus	Brahman-Angus				Africander-Angus half-breds, first generation
		Half-breds		Three-eighths-breds, first generation	Quarter-breds, backcross generation	
		First generation	Second generation			
Steers.........number..	11	15	5	7	22	15
Birth weight.........pounds..	64	71	65	59	62	70
Weaning weight.........do....	404	454	453	435	444	444
Gain from birth to weaning.do....	340	383	388	376	382	374
Age when weaned.........days..	265. 5	232. 0	227. 0	252. 0	237. 5	228. 0
Daily gain to weaning...pounds..	1. 28	1. 70	1. 71	1. 49	1. 61	1. 64
Final weight.........do....	754	754	754	748	752	753
Cold carcass weight.........do....	398	414	411	384	411	399
Gain on feed.........do....	350	299	300	313	308	309
Period on feed.........days..	294	235	233	261	257	246
Daily gain on feed.........pounds..	1. 19	1. 27	1. 29	1. 20	1. 20	1. 25
Efficiency [1].........	11. 45	11. 32	11. 32	10. 86	10. 45	10. 85
Carcass grade [2].........	16. 7	19. 0	18. 8	17. 1	17. 8	19. 1
Carcass yield [3].........percent..	52. 74	54. 91	54. 51	51. 37	54. 64	53. 02
Age at slaughter.........days..	559. 6	467. 5	459. 2	513. 0	494. 1	474. 0

[1] Gain per 100 pounds' digestible nutrients consumed.

[2] Prime, 1 to 6; Choice, 8 to 12; Good, 14 to 18; Commercial, 20 to 24; Utility, 26 to 30; Cutter, 32 to 36.

[3] Based on cold-carcass weights divided by final weights.

In carcass grade, purebred Angus steers ranked first, three-eighths-breds and quarter-breds second, and half-bred Brahman × Angus and Africander × Angus third. The beef conformation of the half-breds, therefore, was not as good as that of steers with a higher percentage of Aberdeen-Angus blood. On the other hand, the half-breds and quarter-breds excelled in carcass yield. Results for the Angus and the three-eighths-bred steers indicated a heavy shrinkage from feed lot to slaughterhouse. Quarter-breds as a group had the lowest feed-lot efficiency. They required 37 days less in the feed lot than the purebred Angus calves and 22 days more than the first-generation half-breds. Half-breds of Africander × Angus breeding were slightly less efficient in the utilization of feed than Brahman × Angus half-breds and had similar carcass grades but lower carcass yields. Purebred Angus required 560 days from birth to reach slaughter weights, or approximately 92 to 100 days longer than half-breds, 65 days longer than quarter-breds, and 47 days longer than three-eighths-bred steers.

In the tests in which steers were sold for slaughter at weaning time (table 5), the number of calves in several of the groups was limited, owing to selection of bulls for replacement and the practice of within-line matings carried out with the established lines. Sufficient data for comparisons were available for only the second-generation quarter-bred, the first generation three-eighths-bred, and the second-generation Africander-Angus half-bred lines. Of these three groups, the quarter-breds excelled in 6-month weights, weaning weights, sales and cold-carcass weights, carcass yield, and carcass grade. The three-eighths-bred line was the lowest except in sales weight and carcass grade. One important point to be considered in connection with these data is the fact that most of these calves came from young cows, which on the average had small calves. The second-generation Brahman-Angus quarter-breds, as a group, came from the oldest cows.

TABLE 5.—*Beef-production data for crossbred steers sold for slaughter at weaning time*

Item	Brahman-Angus—		Africander-Angus half-breds, second generation
	Quarter-breds, second generation	Three-eighths breds, first generation	
Steers ..... number	26	6	12
Birth weight ..... pounds	71. 0	58. 8	61. 3
6-month weight ..... do	396. 0	324. 2	341. 0
Weaning weight ..... do	410. 5	349. 2	352. 6
Age at weaning ..... days	213. 8	220. 3	219. 8
Gains from birth to 6 months ..... pounds	325. 0	265. 3	279. 8
Gains from birth to weaning ..... do	339. 5	290. 3	291. 3
Sales weight ..... do	383. 1	330. 8	330. 0
Cold-carcass weight ..... do	211. 4	168. 2	175. 2
Average carcass yield [1] ..... percent	51. 49	48. 16	49. 68
Average carcass grade [2]	19. 46	23. 30	24. 00

[1] Based on cold-carcass weight divided by final weight (weaning weight in this case).

[2] Prime, 1 to 6; Choice, 8 to 12; Good, 14 to 18; Commercial, 20 to 24; Utility, 26 to 30; Cutter, 32 to 36.

HEAT TOLERANCE

Preliminary heat-tolerance tests were made at the Iberia station with purebred Brahman and Aberdeen-Angus cows and Brahman-Angus half-breds when the average 10 a. m. air temperature was 90.9° F., the relative humidity 82.8 percent, and the wind velocity 2.1 miles per hour, and the 3 p. m. temperature was 93.2° F., the relative humidity 71.1 percent, and the wind velocity 4.5 miles per hour. The results are shown in table 6.

The Brahman cows had a body temperature of 1.1° above normal; the half-breds, 1.6°; and the Angus, 4.1°. Body temperatures for the Brahmans and half-breds were not excessive, but the temperatures of the Angus cows caused them to seek shade.

A summary of heat-tolerance studies carried out with Brahman-Angus and Africander-Angus crossbred lines beginning in 1941, when the individuals were tested first as yearling heifers, is given in table 7. Except for the yearling heifers, no significant differences in heat tolerance were found among the crossbred groups. With the yearling heifers, however, a highly significant difference was found between the two crossbred lines, showing that the body temperature of the Africander-Angus animals was considerably higher than that of the Brahman-Angus. No significant differences were found among the three Brahman-Angus yearling crossbred groups.

Table 6.—*Heat-tolerance coefficients of Brahman, half-bred Brahman-Angus, and purebred Angus cows*

Breeding group	Animals	Tests	Heat-tolerance coefficient	Body temperature as determined from heat-tolerance coefficient
	Number	*Number*		*° F.*
Brahman	7	18	89	102. 1
Half-bred Brahman-Angus	19	67	84	102. 6
Angus	31	69	59	105. 1

The table also shows that, as a group, the 95 mature dry cows had the highest heat-tolerance coefficient, the 135 2-year-old heifers ranked second, the 119 lactating cows ranked third, and the 180 yearling heifers had the lowest coefficient and, consequently, the highest body temperature of the four groups. The differences in heat-tolerance coefficients among the four groups were highly significant.

Table 7.—*Summary of heat-tolerance results for females in crossbred lines* [1]

Breeding group	Heifers				Mature cows			
	Yearlings		2-year-olds		Dry		Lactating	
	Number	Heat tolerance coefficient	Number	Heat tolerance coefficient	Number	Heat tolerance coefficient	Number	Heat tolerance coefficient
Brahman-Angus:								
Half-breds	12	81. 25	11	86. 45	13	87. 77	32	84. 66
Quarter-breds	84	80. 06	63	85. 46	23	89. 31	49	83. 63
Three-eighths-breds	47	80. 98	32	86. 34	10	88. 85	15	84. 80
Africander-Angus:								
Half-breds	37	77. 49	29	85. 96	13	89. 12	23	82. 48
Total or mean	180	79. 85	135	85. 90	95	88. 90	119	83. 80

[1] A low heat-tolerance coefficient signifies a high body temperature; a high coefficient, a low body temperature.

General Appearance of Crossbreds

The crossbred cattle in the three Brahman × Angus lines (table 3) are generally black. Beef conformation and the polled character are exhibited to the highest degree in the lines that carry the least Brahman blood. The hump at the withers and the loose skin on the dewlap and navel, characteristic of Brahman cattle, decrease prominently with increase of Angus blood.

The half-bred cattle appear to be intermediate in beef conformation between the Brahman and Angus foundation (figs. 3 and 4). Bulls and cows have relatively long narrow heads, large prominent ears, and short shiny hair. The bulls have a rather pronounced hump. Females do not have much of a hump, tend to be leggy or upstanding, and have deep long bodies, fairly straight rumps, and well-muscled

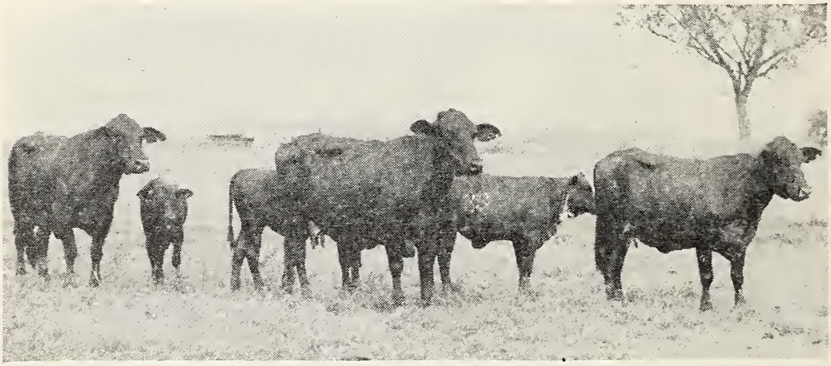

Figure 3.—½ Brahman-½ Angus cows with their second-generation calves. Center cow is 14 years of age.

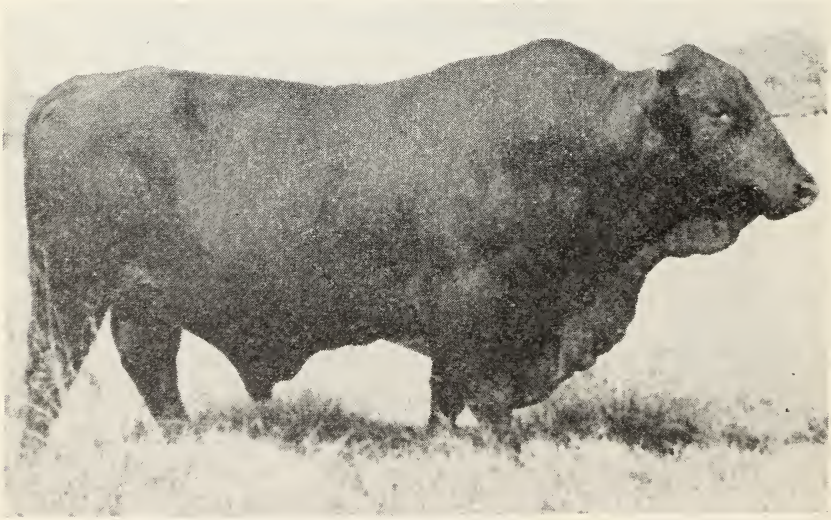

Figure 4.—Half-bred Brahman-Angus herd bull.

hindquarters. Cows of this cross are good milkers, have exceptional vigor, and usually are productive at an advanced age. Their hair is generally black, with the glossy, shiny appearance typical of Brahmans. Approximately 5 percent of the males and 30 percent of the females in the present studies were polled; the remainder of each sex showed distinct horns or scurs.

Backcross or second-generation quarter-bred cattle (fig. 5) resemble the Aberdeen-Angus foundation stock more than first-generation half-bred cattle in beef conformation, and their hair coat is heavier and rougher. They have wider heads, smaller ears, and lower set, shorter bodies than the half-breds, and the cows weigh approximately 70 pounds less at 6 years of age. As a group, they do not appear to be as heavy milk producers as the half-breds. About 55 percent of the males and 80 percent of the females at the Iberia station during the study were polled, the remainder of both sexes showing horns or buttons. Nearly 75 percent of the males and about 80 percent of the females were solid black; the remainder of both sexes were brownish black, mottled black and white, or roan and brindle.

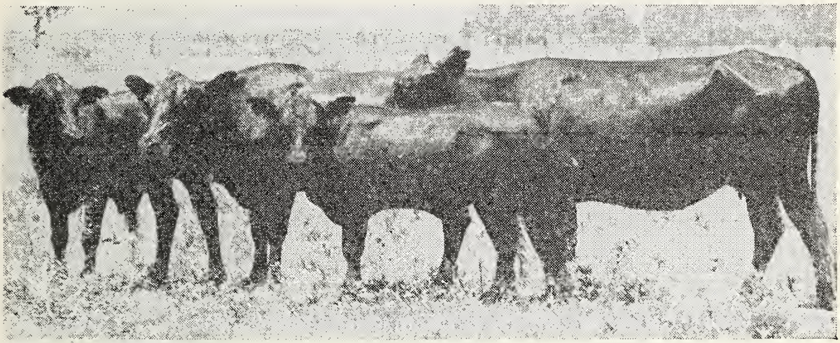

FIGURE 5.—¼ Brahman-¾ Angus cows with their second-generation calves.

The first-generation three-eighths-bred line (fig. 6) is the result of two methods of mating between foundation half-bred and quarter-bred lines, as shown by table 3. These cattle show considerable variation in type but in general appearance approach half-breds more nearly than they do quarter-breds. They have Brahman-type hair (short and shiny) and the ear and skin characters typical of half-breds. The females weigh less at 2 and 3 years of age than foundation half-breds, but the line is new and significant numbers are not yet available. In these studies, about 50 percent of the males and 80 percent of the females were polled, the remainder of both sexes having horns or scurs. About 55 percent of the males and 70 percent of the females were solid black.

The Africander-Angus lines (figs. 7 and 8) consist primarily of first- and second-generation half-breds. They resemble Brahman-Angus quarter-breds in beef type and may be either red or black. The cows reach approximately the same weight at maturity as Brahman-Angus half-breds. Both sexes have relatively long, large heads with small, erect ears, and tend to be less temperamental than Brahman-Angus crosses. The cows are easy keepers, with a pronounced tendency to remain in good condition during the lactation period, at a sacrifice in milk production. As a result, calves are lighter in weight at 6 months of age than is desirable, but male calves feed out well, and females attain satisfactory size at maturity. In this halfbred line, approximately 15 percent of the males and 25 percent of the females were polled; the remainder of both sexes showed horns, scurs, or buttons.

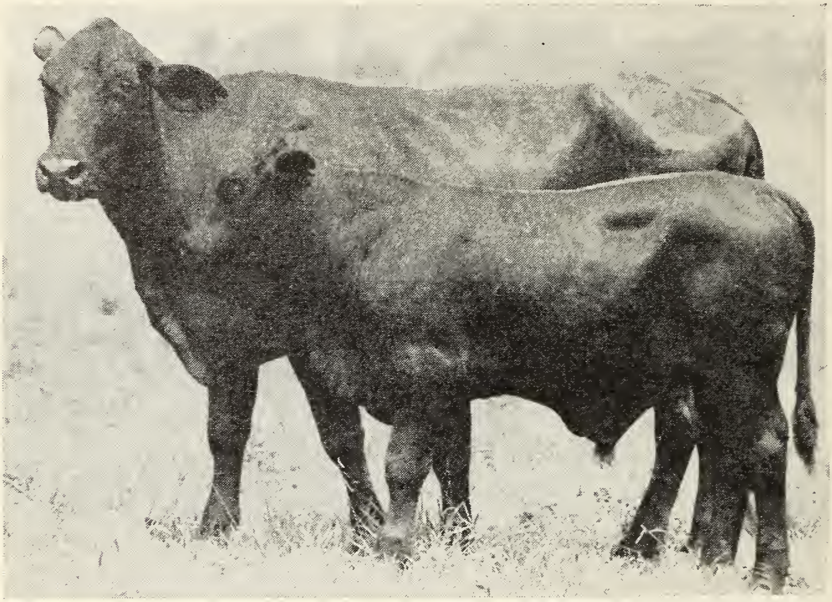

FIGURE 6.—⅜ Brahman-⅝ Angus cow with her calf by sire of the same breeding.

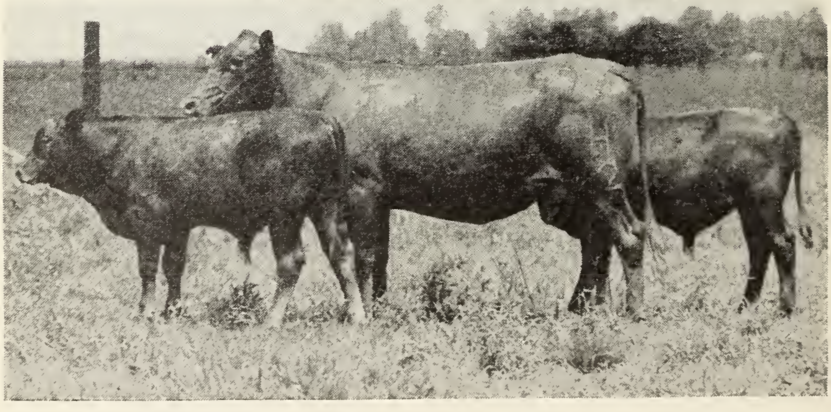

FIGURE 7.—½ Africander-½ Angus cow with two calves of ⅜ Africander-⅝ Angus breeding.

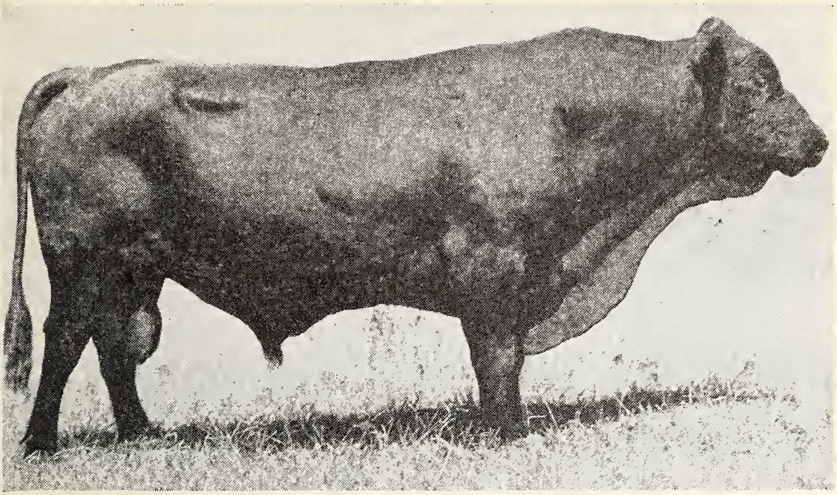

FIGURE 8.—Six-year-old ¼ Africander-¾ Angus bull.

SUMMARY AND CONCLUSIONS

Experiments carried on at the Iberia Livestock Experiment Farm, Jeanerette, La., since 1916 indicate that crossbred cattle have a definite place in the beef-cattle industry of the Gulf coast. However, care must be exercised in the selection of breeding stock and in the subsequent production of crossbred types. When grade cows were used as a foundation, best results were obtained by using a bull of one of the standard beef breeds, then crossing the first-generation heifers with a Brahman bull and backcrossing the resulting female progeny with a bull of the same breed as the original beef-type bull.

When purebred Aberdeen-Angus cows were used as foundation matings with Brahman bulls, the average weight of their calves at 6 months of age was 349.5 pounds. Comparable calves from purebred Angus cows weighed 292.5 pounds. At 6 years of age, after their calves were weaned, purebred Angus cows born at the station weighed 910.5 pounds; the first-generation Brahman-Angus cows weighed 1,047.8 pounds. At this time the latter cows were 69 pounds heavier than first-generation quarter-bred and second-generation three-eighths-bred cows. When first-generation half-bred cows were used to produce quarter-bred and three-eighths-bred calves, heavier 6-month calf weights were obtained than from the following: The reciprocal crosses, quarter-bred cows bred to half-bred bulls to produce three-eighths-bred progeny, quarter-bred cows mated with quarter-bred bulls to produce second-generation quarter-breds, Angus cows mated with half-bred bulls to produce additional quarter-bred progeny. The half-bred cows have long, deep bodies, well-muscled hindquarters, and a tendency to be leggy or upstanding in type.

Fifteen first-generation Brahman-Angus half-bred steer calves reached a weaning weight of 454 pounds at 232 days of age and needed only 235 days in the feed lot to attain a final weight of 754 pounds. On the other hand, 11 purebred Aberdeen-Angus steer calves required

265.5 days to reach a weaning weight of only 404 pounds and 294 days in the feed lot to attain a final weight of 754 pounds, or 92.1 days longer from birth to slaughter. This difference is statistically significant from a breeding and feeding standpoint. The crossbred steers were fully as efficient as the purebred steers in the use of feeds and had higher carcass yields but slightly lower carcass grades. Results obtained for 5 second-generation steers showed that they compared favorably with the first-generation steers in age required to reach 750 pounds, feed-lot efficiency, and carcass yield.

The Brahman-Angus quarter-breds, produced by mating Aberdeen-Angus bulls to half-bred cows and half-bred bulls to Aberdeen-Angus cows, averaged 375.1 pounds at 6 months of age and 979 pounds at 6 years of age. The quarter-breds produced by half-bred dams weighed significantly more than the reciprocal-cross progeny at 6 months of age, but weight differences between the two groups at 6 years of age were not significant. Quarter-breds resemble foundation Aberdeen-Angus more than half-breds in beef conformation, and in texture and color of hair are more like the Angus breed. They are lower set than half-breds, weigh 69 pounds less at 6 years of age, and as a group do not appear to be as heavy milk producers. Steer calves required 237.5 days to reach a weaning weight of 444 pounds and a 257-day feeding period for a final weight of 752 pounds, or 22 days longer than first-cross half-breds. As a group they had the lowest feed-lot efficiency, higher grading carcasses than the half-breds, and equalled first- and second-generation half-breds in carcass yield.

In the three-eighths-bred lines, produced by mating half-bred cows with quarter-bred bulls and quarter-bred cows with half-bred bulls, females weighed approximately the same at birth and at 6 months as first-generation quarter-breds but had a slower growth rate up to 3 years of age. At 6 months and 1 year the three-eighths-bred females produced by half-bred dams and quarter-bred sires excelled the females from the reciprocal cross, as in quarter-bred matings, but when older they lost this advantage. As 3-year-old heifers the three-eighths-breds, as a group, were inferior in size to both half-breds and first-generation quarter-breds. Cows in this line are highly variable but resemble half-breds more than quarter-breds in type. The three-eighths-bred steer calves required 252 days to reach a weaning weight of 435 pounds and 261 days to reach an average weight of 748 pounds in the feed lot. These calves required 19 days longer than quarter-breds and 46 days longer than first-generation half-breds to reach a slaughter weight of approximately 750 pounds.

Purebred Aberdeen-Angus cows were also used for foundation matings with Africander bulls, and most of the progeny were half-breds. First-generation Africander-Angus females weighed the same at 6 months and also at 6 years as first-generation Brahman-Angus females. Second-generation Africander-Angus half-breds excelled purebred Angus at 6 months of age but were inferior to all Brahman-Angus crossbred lines. First-generation half-bred steer calves sired by Africander bulls reached an average weaning weight of 444 pounds in 228 days and required 246 days in the feed lot to gain 309 pounds, or a total of only 7 days longer than was required by half-bred first-generation Brahman-Angus steers to reach a slaughter weight of about 750 pounds. These calves compared very favorably with the Brahman-

Angus half-breds in carcass grade. They made practically as rapid gains on feed but had a slightly lower carcass yield.

The half-bred Africander-Angus cows resemble Brahman-Angus quarter-breds in beef type. Most of them have short, smooth, and shiny hair and their coats are either red or black. The cows, as a group, are not heavy milkers and under adverse grazing conditions tend to maintain body condition at the expense of calf production.

Studies to determine the body temperature of purebred and crossbred types of cattle were conducted, and a formula for an easy field test to determine heat-tolerance coefficients was developed. In the early work, it was shown that the heat-tolerance coefficients were 89 for purebred Brahman cows, 59 for purebred Angus cows and 84 for half-bred Brahman-Angus cows. A low heat-tolerance coefficient signifies a high body temperature; a high coefficient, a low body temperature. Much of the low growth rate exhibited by Aberdeen-Angus cattle under subtropical conditions can, no doubt, be attributed to the fact that they suffer from heat when adequate shade is not available.

Subsequent studies with crossbred cattle, including Brahman-Angus half-bred, quarter-bred, and three-eighths-bred lines and Africander-Angus half-breds, indicate that differences in heat tolerance between groups of mature lactating cows are not statistically significant. All crossbred groups apparently have sufficient Brahman or Africander blood to provide adequate protection from the sun's rays for this climate. Milking cows have a higher body temperature, and, therefore, a lower heat-tolerance coefficient than dry cows.

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